earlier edition. Chapters on the overfall and arched types of dam have been added, and an excellent series of cross-sections of typical masonry dams, arranged chronologically, forms an appendix. The method of analysis followed is that due to Wegmann, used for the first time in connection with the design of the new Croton dam. The authors have amplified the analysis by a consideration of the uplift due to water penetrating the foundations or the horizontal joints of the masonry, and also by taking into account the ice-thrust exerted against the up-stream face of the dam when the reservoir is frozen over. The latter portion of the book is devoted to the problems of tension in the vertical sections near the toe, to which attention was first directed by L. W. Atcherly. Appendices i. and ii. contain the mathematical theory of arch dams. The book is one which should occupy a place in the library of all designers of masonry dams.

(4) Probably one of the most difficult problems which the engineering designer has to face is that concerned with the pressures which may exist at the back of retaining walls. Many mathematical theories have been evolved which assist materially in solving the problem, but the infinite variety of physical conditions met with in the earth's crust render exact calculations impossible in many cases. This difficulty is undoubtedly responsible for the comparatively small amount of experimental work available. The book on earth pressures just issued by the professor of mathematics in the University of North Carolina deals with the theory of soil pressures, covering a wide range of physical properties of earth, from those of Rankine, where the soil is assumed to be devoid of cohesion and subjected to no other external force than its own weight, to cases where surcharging and cohesion are taken into account.

Both analytical and graphical methods are employed, and the work is comprehensive in scope. The last chapter is devoted to a consideration of bin theory, the ordinary hopper-bin containing coal or ore and the deep bin such as those met with in grain silos being dealt with in an adequate manner. The stresses in wedge-shaped reinforced-concrete bins, such as occur frequently in the toes, heels, and counterforts of retaining walls, form the subject of an appendix, whilst some experiments made by the author on model retaining walls at the limit of stability are dealt with in Appendix ii. The book well repays the reader. It ought to serve a useful end.

THE GEOLOGY AND SUPPLY OF MINERAL OIL.

Principles of Oil and Gas Production. By Prof. B. H. Johnson and L. G. Huntley. Pp. xv+371. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 16*s*. net.

THIS book should be of especial usefulness owing to its combination of practical information, including branches of the subject not usually considered in general text-books on oil-mining, and its clear and accurate statements of scientific principles. The twenty-three chapters may be divided into three groups: the first is devoted to the chemistry, physical qualities, and geology of oil and natural gas; the second includes eleven chapters on the development and management of oil and gas wells; and the third, consisting of one chapter which occupies nearly a third of the book, gives a most useful summary of existing knowledge of the oil and gas fields of North America.

The most striking feature of the first division of the work is its clear expression of the reaction from the school which held that the one determining factor in oil geology is the folding of the beds. It is no doubt true that the folding has often largely determined the distribution of the oil, and is the best guide in the economic development of the field. There are, however, numerous cases in which the rocks are not folded, yet the concentration of the oil into pools is due to the factors which elsewhere drove it into the arches of the folds. The authors therefore devote especial attention to the texture of the beds, to the variation in the range of those most suitable for oil storage, and to the forces which have compressed the oil into pools. The authors discuss the origin of mineral oil, and firmly reject the inorganic theories. They recognise the wide range of oil throughout geological time, but that Cambrian and pre-Cambrian rocks are unlikely to contain it in commercial quantities. Important oilfields occur in the Ordovician and in all later systems.

In an interesting chapter on folds the authors urge more general agreement in the meanings of the terms "homocline" and "monocline," and set a good example of concession, as Prof. Johnson abandons his previously advocated use of "monocline" for beds with a uniform dip in one direction. He now accepts Daly's term "homocline" for a bed with one dip, and "monocline" in its more familiar sense for a one-limbed fold. Horizontal beds the authors describe as "aclines"—a perhaps unnecessary term. They introduce the term "chute" for the pitch of a minor fold, which is very different from its usual use in mining geology. The chapter on the laws and leasing of oil lands appears to be a clear synopsis of the American law; it quietly explains how to avoid by suitable terminology the legal decision that the oil or gas under a tract of land cannot be sold. They point out, too, that the oil and gas industries are hampered by anti-trust laws, which in some cases prevent reasonable economic co-operation and necessitate wasteful expenditure.

Perhaps the most valuable section of the book is the description of the oilfields of North America. It is illustrated by an excellent geological map of the continent and numerous diagrams of the special fields. The literature on them appears well up to date. The authors describe the fields, ranging from that of Lima-Indiana, which is unique as yielding its produce from Ordovician beds, to the still more remarkable oilfield among the salt-

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domes of Louisiana. They show that the most recent work has confirmed the hypothesis that these salt-domes occur at the intersection of two rectangular series of fractures. The Calgary field, which created a fever of speculation in south-western Canada, is more than once quoted as illustrating that the predominance of light oils is a discouraging feature as an indication that the oils have travelled for some distance. They refer to the present investigations to check Höfer's theory that the geothermal gradient rises most rapidly in oilfields, but they regard it, even if verified, as a not very hopeful method of prospecting.

The final chapter is on the oil market and future supply. All through the book may be recognised the tacit assumption that the days of an oilfield are short and that a period of declining oil production is not far distant. Then, say the authors, will be the day of the oil shales, of which there are large quantities, which can then be more profitably worked. They remind us, however, that there is not likely ever to be an absolute failure of oil for purposes for which it is indispensable. So soon as oil production begins to decline the price will rise, and its employment will be restricted to the purposes for which oil alone can serve. It will no longer be squandered on uses for which there are more enduring reserves of alternative materials. J. W. G.

OUR BOOKSHELF.

Wisconsin Geological and Natural History Survey. Bulletin No. xxxvi. *The Physical Geography of Wisconsin.* By Dr. Lawrence Martin. Pp. xxii+549. (Madison, Wis.: Published by the State, 1916.)

THE "Educational Series" to which this work belongs is "primarily designed for use by teachers and in the schools" (p. 486), and the cloth-bound volume of 549 pages, with abundant maps and illustrations, is "sent on receipt of 15 cents" (7½*d.*) to those who are sufficiently keen to ask for it. Wisconsin, like Canada, places no bar to the spread of educational information collected by the State.

Dr. Martin is careful to explain technical terms as they arise, but he writes for the advanced teacher, who will appreciate the details shown in his well-selected maps. The romantic history of Indian, French, and American Wisconsin is bound up with the geographical position. To this day (p. 12) the most valuable articles manufactured in the State are "the products of the wood-working industry, which come from the soil." In many ways, even in the abundance of lakelets in the north (p. 388), we are reminded of Finland, where the soils depend also to a large extent on glacial transport. But Wisconsin has some 40 in. of annual rainfall, distributed under the extremes of a continental climate, and the wind-weathering that forms pinnacles and rock-tables in the driftless areas does not imply continuous aridity. On the west we come across the broad sweep of the Mississippi, flowing below Prescott between isolated bluffs, which are in reality the extremities of divides cut through by the young and dominant stream. We are grateful to the author for the sympathetic record on p. 170 of Black Hawk's heroic stand on the Mississippi bluffs in 1832. The human, and thus the humane, touch can never lie far from the geographer. GRENVILLE A. J. COLE.

The North Staffordshire Field Club. Jubilee Volume, 1865–1915. Edited by S. A. H. Burne, J. T. Slobbs, and H. V. Thompson. (Published by J. and C. Mort, Stafford.) Price 7*s.* 6*d.*

AN immense amount of good and useful scientific work has been accomplished during the last fifty years in the United Kingdom by local natural history and archæological societies. Not only have these bodies stimulated local research, but by affording means of publication they have been of inestimable service to science in placing on record accounts of local discoveries, co-ordinating methods of study, and enabling the embryo student to try his prentice hand at authorship.

The North Staffordshire Field Club is a typical society of the kind, and having attained its jubilee, it has just issued a commemorative volume, which consists of a sufficiently full record of the work performed by the members during the fifty years of its existence, compiled by the president, together with an account of the work done in the various sections by the respective chairmen. The work of the club is organised in sections, and is carried on by means of monthly excursions under approved leaders during the summer, and the reading of papers and debate at evening meetings during the winter, and it must be admitted that the results of the fifty years' work are an unqualified success. It is not permitted to everyone to live to see the full fruition of their pioneer work, but the fates have been kind enough to Mr. W. D. Spanton to permit him to live not only to see his offspring successful, but also to act as president on the fiftieth anniversary of the club he was instrumental in founding.

Having now reached maturity, it behoves the club to consider itself more seriously and to extend its work. For example, the histories of Roman and Saxon Staffordshire have still to be written. Botany and zoology include much more than the mere listing of finds, and the annual volumes would be better if shorn of the many platitudes which still add to their bulk, but not to their usefulness.

Macmillan's Graphic Geographies. The British Isles. By B. C. Wallis. Pp. 32. (Macmillan and Co., Ltd.) Price 9*d.*

THE beginner in geography is here provided with a combined atlas and text-book. The simply worded lessons, in which the human note is predominant, are supplemented by four coloured, full-page, orographical maps and twenty-four further maps in black and white. The exercises at the end of the lessons, and the occasional test-papers, will supply the teacher with the material necessary to secure the active co-operation of the pupil throughout the course of instruction.

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